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ERP Project Retrospectives—55 Enterprise Systems: Evaluating Project Success, Lessons Learned, and Business Outcomes

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ABSTRACT

This paper provides a description of fifty-five ERP Project Retrospectives. The study uses the ERP project retrospectives to shed light on relevant issues identified in the literature review of ERP research conducted over the past decade (Schlicher and Kraemmergaard, 2010). The retrospectives provide insight into a number of key questions, including: (1) project justification, including the business and system benefits of ERP; (2) lessons learned, including common mistakes, challenges met, and best practices in managing these challenges; (3) and critical success factors in implementation. The study describes the similarities and differences between the literature and the walkthroughs.

Keywords: ERP implementation, project management, project retrospectives.

Introduction

ERP projects are often the largest projects which organizations undertake. Their size, cost, impact on business processes, and overall risk factors make them complex challenges. In essence, an ERP system provides software which supports and integrates business processes across an organization, using standardized processes and shared data. Generally, ERP-enabled business processes provide an opportunity for business process re-engineering, so that organizations re-engineer business processes in order to take advantage of the "best practices" enabled by the ERP software. The implementation of standardized business processes, shared data, and best practices across an organization produces a significant technological, organizational, and business challenge (Soh, et. al, 2000; Nah and Lau, 2001; Subramoniam, et.al., 2009).

This research provides project retrospectives on 55 ERP projects, using project walkthroughs and a lessons learned repository. The study addresses the question, "what are the differences between what the literature review tells us with respect to ERP implementation and what the case studies reveal are the practical realities of ERP implementation?" The overall objective is to gain a better understanding of these lessons learned and to increase the quality and comprehensiveness of the best practices for managing these projects. The objective is to use practice to strengthen research findings, so that research can apply to practice.

ERP Project Walkthroughs: Why Project Retrospectives are Valuable

The retrospectives provide a variety of benefits, including:

- Insight into project justification, including the business and system benefits of ERP.
- Understanding the lessons learned, including common mistakes, challenges met, and best practices to managing these challenges.
- Understanding critical success factors in ERP implementation.
- Comparing the current knowledge base in ERP implementation to the actual practices shared through the project retrospectives.

Theoretical foundations—A Review of the Literature

The ERP research field has a strong record of implementation studies, and a study of project retrospectives can serve to bring lessons learned and common best practices together. In their comprehensive review of ERP research over a decade, Schichter and Kraemmergaard synthesize 885 peer-reviewed journal publications between 2000 and 2009 in order to gain an understanding of the current status of ERP research and also to develop a framework for identifying areas of concern in designing, implementing and using enterprise systems (Schlicher and Kraemmergaard, 2010).

Of the ERP research reviewed, 80% of the topics fell into the categories of ERP implementation, the management of ERP systems, the optimization of ERP, and on ERP tools. Specifically, 30% focused upon implementation aspects, 20% on managing ERP, 17% on the optimization of ERP, and 14% on ERP tools. The remaining 19% dealt with other ERP topics (Schlichter and Kraemmergaard, 2010).

The purpose of this study is to use ERP project retrospectives to identify the similarities and differences between the literature on ERP implementation and the lessons learned through the project walkthroughs. The findings and analysis of "real-world" case studies will contribute to the quality and comprehensiveness of ERP implementation literature. Experience from practice can strengthen research, so that research can impact practice and provide guidance to improve practice.

The recurring questions in ERP implementation research include:

1. How well does the ERP system fit the business strategy? (Wei, et. al., 2005, Wei and Wang, 2004).
2. Which strategic, managerial, operational and organizational benefits are the result of ERP implementation? (Shang and Seddon, 2002).
3. Which business benefits of ERP systems evolve during the post-implementation period? (Staehr, 2010.
4. Which strategy should implementation use, e.g. "vanilla" implementation? (Parr and Shanks, 2000).
5. Which work tasks and organizational and managerial challenges can be expected in implementation phases? (Markus, et. al, 2000; Kraemmergaard and Rose, 2002).
6. Which critical success factors should we have in mind during the implementation? (Ng, et. al. 2002).
7. To what extent does ERP-led BPR (business process re-engineering) lead to fundamental changes in an organization's structure, culture, and management process? (Huq, et.al., 2006).

For both practitioners and academic professionals, the ERP project retrospectives provide insight into common themes relevant to these issues of project justification, business benefits, vanilla implementation vs. customization, and organizational impacts. The lessons learned repository, which includes issues, best practices, and recommendations, is an important contribution to understanding the process of technology-mediated organizational change, as described by Volkoff (2007), and to understanding the success factors contributing to positive and meaningful change.

The Research Methodology:

The project retrospective interviews were conducted in 55 organizations implementing enterprise systems. The data were collected using a structured walkthrough questionnaire, adapted from Nelson's project retrospective instrument (Nelson, 2005). The data were collected using structured interviews with project managers responsible for enterprise systems implementation projects. Similar to the methodology followed in Nelson's project retrospectives, graduate students were trained in the structured interview protocol and in case study methodology. To strengthen the validity and reliability of the data, the interview data was reviewed in class and by the instructor. This provided feedback and an opportunity to achieve clarity and completeness. The approach to data collection and analysis replicated Nelson's approach to project retrospectives.

The structured interview covered these topics:

1. Project Management: Project manager experience, project team characteristics, and the role of the project steering committee.
2. Project Characteristics: Project scope, project schedule, and project cost—planned vs. actual.

3. Project Benefits: Motivations for the ERP project, including business and system benefits.
4. Lessons Learned: Common Mistakes, issues that occurred when the system went live, user acceptance, and lessons learned.
5. Critical Success Factors in Project Implementation: Project manager expertise, training effectiveness, top management support, role of the project champion, change management, and steering committee leadership.

The full structured interview is in Appendix F. Using the data collected from the ERP Project Walkthroughs, the questions posed by the literature review (Schlicher and Kraemmergaard, 2010) will be addressed and the outcomes will contribute to the lessons learned repository on ERP project success.

Characteristics of the Project Repository:

Organizational Profile: The organizations were broken down in size in terms of sales volume, with 54% organizations with greater than $1 billion in sales, 42% midcap companies with sales between $50 million and $1 billion in sales, and 2 educational institutions (4%).

ERP Systems: The ERP systems selected included large enterprise systems, such as SAP, Oracle, and Peoplesoft: 58%, ERP's addressing the mid-market, such as J.D. Edwards and Lawson: 31%, and industry-specific enterprise systems, such as Viewpoint and Compass: 11%.

Project Sponsor: As a general rule, the ERP projects were sponsored by a senior-level executive, typically the CEO. Key stakeholders included customers, suppliers, shareholders, and employees. Project managers led project teams consisting of full-time team members from business units and external consultants.

Project Cost: Project cost data was available for 30 of the project retrospectives. The ERP project budgets ranged in size from 75,000 to $1,400,000,000, with the average planned budget $43,889,407.41. The average actual project cost was $45,334,370.37 for the projects reporting these results. Comparing expected cost vs. actual cost or ERP project completion, the cost overruns averaged 116.34%.

Project Duration: The project walkthroughs provided data on the Project Start Dates, Actual Completion Dates and Project Duration for both Single Phase and Multiple Phase Projects. The single-phase project retrospectives ranged in duration from 4 to 55 months for projects reporting duration data. The overall average duration for these projects was 21 months. The multiple-phase projects ranged from 7 to 108 months in duration, with an average project duration of 27.5 months. The multiple phases were broken down by project activities, such as planning, design, and construction.

ERP Project Benefits: Research and Practice

What the Research Shows about ERP Benefits:

The business justification for ERP implementation includes process improvement, business process standardization, cross-functional business process integration, inventory reduction, and inventory turns (Ross, 2000; Volkoff, Strong, Elmes, 2005). Gefen and Ragowsky (2005) note the positive benefits in streamlining manufacturing from supply chain integration, enabled by ERP.

Fang and Lin (2006) mention the need to focus on metrics related to re-engineering business processes, along with financial results. In their assessment of the return on investment to ERP, Fang and Lin use the Balanced Scorecard approach, which incorporates both financial returns as well as returns from business process integration, process improvement, and integration of business processes. The reduction in bottlenecks, improved response time in order processing, reduced response time in delivery processing, and improved employee productivity are all measurable business benefits of the investment in ERP which translate into improved future financial performance (Fang and Lin, 2006).

Ranganthan and Brown's (2006) research suggests that investments in ERP can result in positive stock value measures. Shareholder value is enhanced by the investment in ERP, because of the pay-off to the investment in ERP in terms of

improved business processes and future growth (Ranganathan and Brown 2006). Hendricks, Kevin B., Vinod R. Singhal, and Jeff K. Stratman (2007) found that while there was an improvement in profitability for ERP implementations, there was no correlating rise in stock price.

In their study of the impact of ERP systems on firm performance, Wieder, et. al., (2006) address the question of whether firms who have an ERP system deployed are more efficient that firms who do not have an ERP system deployed, using both financial and non-financial performance measures in their analysis. These measures include information technology measures, business process performance measures, and firm performance measures. The non-financial measures focus on flexibility, reliability and responsiveness along the supply chain. Based upon their findings, the evidence suggested that ERP implementations provide financial and operational benefits, but that the payback of ERP is not realized in the short-term, but rather in the long-term (Wieder, et. al., 2006).

Seddon, et. al. (2010) provide a comprehensive list of the organizational benefits of ERP, including:

- Integrated organizational system: Enterprise systems lead to the development of an integrated system within the organization. This helps in streamlining of organizational processes and workflow, resulting in improved efficiency.
- Improved data entry: Due to the integration of all systems in an organization, there is little or no entry of redundant data and processes throughout the system.
- Incorporation of best practices: The establishment of the enterprise systems in an organization results in the incorporation of best industry practices, leading to an overall improvement in the workings of the organization.
- Flow of information: Sharing of information across all departments of an organization leads to improved interdepartmental communication and better employee performance.
- Improved customer satisfaction: As workflow improves, resulting in on-time delivery of desired goods and services to customers, customer satisfaction is increased.
- Reduced inventory costs: The incorporation of concepts like SCM, CRM and ERP in enterprise systems results in better planning, forecasting of requirements, and reduced inventory cost.

What the ERP Project Retrospectives Say about ERP Benefits:

Business Benefits of ERP:

The assessment of ERP Benefits for the ERP Project Retrospectives included: (1) Expected Benefits; (2) Actual Benefits; and (3) Business Benefits which were both Expected and Actual. For the purposes of the synthesis, the following business benefits were both Expected and Actual; these are consistent with Seddon's categorization:

- Integrated organizational system/integrated data: Standardization of systems, Efficient systems/integrated systems
- Incorporation of best practices: Increased employee productivity, Workforce reduction, Self-service applications, Better services management
- Flow of information: Improved accounting/billing/AR, Faster financial reporting/closing, Efficiency with HR/payroll/benefits
- Improved customer satisfaction: Increased customer satisfaction
- Reduced inventory costs: Inventory reduction, Improved production line usage, Inventory turns improvement, Cost savings, Reduce purchasing cost/procurement synergy
- Improved planning: Increased sales/increased order size

System Benefits of ERP:

Systems benefits depict improvements in information systems effectiveness and efficiency. The benefits of systems integration:

- Standardized processes
- Efficiency
- Data integration
- Improved system performance

- Scalability
- Better access to data

The benefits of systems integration and standardized processes were both expected and actual by some organizations, but expected and not actually realized by an equal number of organizations. Cost-reduction in the maintenance of legacy systems was expected, but not actually achieved. Better access to customer data was an expected benefit, but not actually realized. An equal number of organizations reported that data integration was both expected and actual as the organizations reporting that data integration was expected but not actually achieved.

As we move toward understanding the lessons learned from the projects, some of the reasons for the slow pace of realizing some of these benefits may become apparent. The process of implementing new processes involves considerable organizational change and re-structuring—and some of these changes are difficult to manage and implement.

Implementation Factors:

What the Literature Says about Implementation Factors:

The literature review on factors contributing to ERP implementation success provides an assessment of requirements analysis, design and implementation factors—including data migration quality, training, and testing. Project management factors, including communications, teamwork, scope management, influence project success. Additional factors associated with successful implementation are the use of external consultants, the role of the champion, and the measurement of business results.

Successful implementation of ERP systems require accurate data migration (Hakkinen and Pekka, 2008; Momoh, Roy, and Shehab, 2010), thorough testing (Motwani, Mirchandani, Madan, Gunasekaran, 2002; Gargeya and Brady, 2005), and effective training (Markus, Axline, Petrie, Tanis, 2000; Gargeya and Brady, 2005).

Additional implementation success factors include soft skills, especially effective communications (Motwani, Mirchandani, Madan, Gunasekaran, 2002), and teamwork (Nah, Lau, and Kuang, 2001; Newell, Huang and Tansley, 2006; Momoh, Roy and Shehab, 2010). The role of the champion is also associated with project success (Harley, Wright, Hall, Dery, 2006), along with understanding the organizational culture (Scott and Vessey, 2000; Zhang, et. al, 2005; Gargeya and Brady, 2005).

Project management factors are important to implementation success. Project management involves effective scope management (Scott and Vesey, 2000; Gargeya and Brady, 2005); and project planning and control (Scott and Vessey, 2000; Zhang, Lee, Huang, Zhang, Huang, 2005); Gargeya and Brady, 2005; Karimi, Somers, Bhattacherjee, 2007; Mandal and Gunasekaren, 2003; and Momoh, Roy and Shehab, 2010). A summary of literature related to ERP implementation success:

What the Walkthroughs Show about ERP Implementation: Lessons Learned

Organizing the lessons learned and implementation challenges by the systems development life cycle, including requirements, design, and implementation, you can see that some of the recurring themes highlighted through quotes from project managers.

Adopt Standardized Processes: The challenge of introducing new, optimized processes is very clear, and scope creep is the issue to be controlled. The quotes tell the story: "Avoid scope creep; limit customization;" "Bring consultants to recommend best practices;" "Optimize processes;" "Understand business processes;" "Avoid slow implementation of new processes." Practice tells us that the adoption of best practices based upon the processes supported by the software is instrumental in successful implementation.

Understand the Importance of Data Migration: Practice tells us that data migration is one of the most important challenges in transitioning from a legacy system to an enterprise system: "Address the challenge of transitioning information from a patchwork legacy system;" "Use cleansed data;" and "Focus on data quality in the design phase."

Testing is Essential: Practice emphasized the importance of thorough testing: "Create separate environment – mimic production;" "Maintain accurate configuration control system;" "Anticipate the importance of test systems;" and "Avoid the rush into production."

Training, training, training: Practice reinforces the importance of training: "Training, training, training;" "No amount of training is enough" is a message re-iterated by the majority of the project managers responsible for ERP implementation.

Follow project management best practices: Practice confirms the importance of following project management best practices: "Define roles/responsibilities of project team;" "Maintain budget;" "Commit the team to ERP implementation;" and "Strengthen communications."

Learn how to work closely with vendors: Practice confirms the strategic importance of creating and maintaining successful vendor relationships throughout project implementation: Practice warns against issues that arise when vendor partnerships are not right: "Avoid believing vendor's account of what the package could do;" "Watch vendor over-commitment to other projects;" "Anticipate developer problems;" "Caution: Vendor over-promising; " "Identify vendor consultants with application expertise." Developing constructive relationships with vendor partners is critical to project success.

Understand the important role of the super-users: Super-users are subject-matter experts who are "in the trenches" when it comes to adopting ERP-enabled processes, learning new workflows, orchestrating change, overseeing testing, providing training, and providing a support system throughout both implementation and maintenance. The role of these super-users is very important, as seen through the eyes of the project managers: "Successful implementation depends upon a dedicated team;" "Super-users critical to addressing issues and training;" "Recognize that inexperienced implementation people cause problems." These super-users need to develop systems building skills along with using their domain-specific knowledge to understand and to build new processes and workflows.

Similarities and Differences between the Literature Review and Project Walkthroughs:

The comparison between what the review of the literature reveals in terms of factors contributing to ERP implementation success and what the project walkthroughs say illustrates both commonalities and differences. The commonalities are the importance of requirements analysis, business process re-design, and implementation success factors such as data migration, testing, and training. Successful use of project management best practices and processes in the management of ERP projects, including scope management, is noted both in the review of the literature and in the project walkthroughs.

There are three differences in what the review of the literature says with respect to ERP project design/implementation and what the walkthroughs reveal make a considerable difference in practice:

1. Vendor Partnerships: Vendor dependence is emphasized in the case studies. Because organizations rely upon vendor-created and supported software, there is a significant dependence upon vendor capabilities in ERP projects. The recurring theme of vendors' over-committing and over-promising solutions, support, and expertise is a unique challenge to commercial-off-the-shelf software implementation projects such as ERP projects and calls for a greater focus on developing successful vendor partnerships.
2. Role of the Super-User: The emerging and important role of super-users in the implementation process is stressed in practice. Super-users are subject-matter experts (SME's) who understand the underlying business processes. They must be proactive in learning new processes and in leading their adoption. Successful implementation requires super-users to take on important roles in system configuration, training, support, and troubleshooting.
3. The Importance of Data Migration (cleansing, qualifying, simplifying data) is accentuated in the case studies, as contrasted with the literature review.

Similarities and Differences – Critical Success Factors

While there are many similar themes dealing with the process, organizational and project management challenges of ERP implementations, there are some distinct differences between what the literature reports and what practice shows.

1. Customization may be necessary: First, the literature reinforces the value of business process re-engineering and adopting new processes based upon the software system. In practice, about 25% of the organizations felt it necessary to customize the software in order to support unique business processes, even though customization normally amounted to time and cost overruns. The data on the projects in which customization was reported 15 companies customizing the software reported cost and schedule overruns. While customizations may lead to time and cost overruns in terms of the project schedule, the business justification may warrant changes in scope in order to accommodate these changes.
2. Challenge of ERP Skill Sets—based upon the project retrospectives, both End-user Skill Sets and IT skill sets were not yet fully developed to support ERP implementation. 53% of the IT professionals did not have ERP skill sets, and 34% of the end-users lacked ERP knowledge. This apparent lack of background by both IT professionals and end-users accentuates the criticality of training—another lesson-learned from the retrospectives.

Limitations and Research Opportunities

The case study organizations are taken from a regional sample representing a cross-section of mid-sized and large enterprises, representing a variety of industries. The extensive project retrospective repository, consisting of 55 project walkthroughs conducted over five years, provides a cross-section that is relevant to addressing the question: what are the similarities and differences between what the literature says and what practice says with respect to the best practices and lessons learned in ERP implementation.

Opportunities for Further Research

The ERP project retrospectives provide a lessons learned repository of best practices, pitfalls to avoid, and critical success factors in enterprise systems implementation. They also raise new issues which can be addressed in further research, including:

- Given the importance of business process change in the context of ERP implementation, it would be interesting to compare the success of ERP project implementation within organizations with varying organizational climates (e.g. collaborative, "flat," team-based climates vs. hierarchical, structured organizational climates). The silo-based organizational structures may be more resistant to change and less likely to adopt cross-functional business processes.
- Given the importance of vendor partnerships in ERP project success, it would be valuable to compare positive vs. negative vendor relationships and their impact upon project success, as measured by dependent variables such as project cost, project schedule, and user satisfaction.
- The underlying enterprise architecture for ERP can influence project success. Does a standardized IT infrastructure provide a foundation for building enterprise systems? Alternatively, can a cloud services or hosted infrastructure work suitably as a foundation for building enterprise systems?
- The people-side of ERP implementation needs to be investigated in further research. What are the key competencies (skills, knowledge, attitudes) of subject-matter experts (SME's) who serve as "super-users" in ERP implementation projects? What domain-specific competencies are needed? What IT-based skill sets are needed?

Summary and Conclusions:

Based upon the project retrospectives, the lessons learned repository provides several themes which re-occur throughout the walkthroughs. These themes go beyond the best practices already defined in the existing literature.

The Role of Super-Users: The ERP project retrospectives confirm the importance of functional expertise on the project team. ERP systems integrate cross-functional processes, and functional managers need to understand these processes. Super-users are subject-matter experts who understand business processes and play an important role in systems implementation success, including configuration, testing, training, and end-user support.

Vendor Partnerships: The project retrospectives emphasize the importance of vendor relationships. A negative relationship can seriously erode project implementation success. Throughout the case studies, there is mention of vendor failures, poor vendor technical support, and over-promising results. Mitigating these risks contributes to project success.

Data Migration is Critical: The project retrospectives emphasized the critical importance of data migration, including cleansing, simplifying and consolidating legacy data streams. The time and effort which needs to be allocated to data migration and conversion issues is largely under-estimated. Poor data quality can cause implementation problems down the line.

End-Users and IT Professionals need to Acquire ERP Skill Sets: The apparent lack of ERP skill sets, for both end-users and IT professionals, accentuates the need for training—not only in technical skills about also business process knowledge supported by the new system. This training may need to be continuously reinforced and updated.

Customization may be a Business Requirement: While the consistent best practice is not to customize ERP systems, the experience of the project walkthroughs revealed that customization occurred and was business-justified, even though customization may cause project cost and schedule overruns.

In summary, the ERP project retrospectives provide insight into best practices, lessons learned, and critical success factors, including process design, organizational factors, and project-related challenges. Overall, these insights can help guide practice and enable future researchers to address "real-world" issues that will continue to impact practice.

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